REMARKS

Favorable consideration and allowance of the present application are respectfully requested in view of the following remarks.

Currently, claims 1-2, 4-13, 42, and 44-63 are pending in the present application, including independent claims 1, 46, and 48-50. Independent claim 1, for example, is directed to a method for heat treating a semiconductor wafer. The wafer is placed in a thermal processing chamber that is in communication with a plurality of lamps, and the wafer defines a plurality of localized regions along a radial axis. The temperature of the semiconductor wafer is adjusted to a predetermined temperature according to a predetermined heat cycle, and this heat cycle includes a heating stage during which the semiconductor wafer is heated by the plurality of lamps. During at least one stage of the heat cycle, a gas is provided to selectively control the temperature of at least one of the localized regions of the semiconductor wafer to minimize temperature deviation of the at least one localized region from the predetermined temperature.

Claims 1, 2, 5, 8-13, 44-45, 48, 50-51, 53, 56-60, and 62-63—which include independent claims 1, 48, and 50—were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,814,365 to Mahawili. Mahawili is directed to a reactor and a method for processing a semiconductor substrate. The reactor of Mahawili contains, *as separate parts*, (1) a heater assembly, (2) an emissivity measurement assembly, and (3) a gas injection assembly. The emissivity measurement assembly measures the photon density from a light source and the reflected photon density off the substrate, and these emissivity measurements are used to determine the temperature of the substrate. (Col. 2, lines 54-62). The gas injection assembly in the reactor of Mahawili is adapted to inject and direct at least one gas onto a discrete area of the semiconductor substrate, and this gas injection assembly may include a plurality of gas injectors. (Col. 3, lines 4-10 and 37-58).

Applicants respectfully submit, however, that Mahawili does not disclose the method of Applicants' independent claims 1, 48, and 50. Each of these claims (as well as independent claims 46 and 49) requires the step of ***providing a gas to selectively control the temperature*** of at least one of the localized regions of a semiconductor

wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. This step is simply not present in Mahawili.

Throughout Mahawili, *temperature control* of the substrate occurs in the following ways:

- Mahawili's heater assembly (i.e., 14 in Figures 2-3 and 6), which is enclosed in heater housing 16, includes an array of heating elements such as linear tungsten-halogen lamps. (Col. 4, line 60 – col. 5, line 22). Heater assembly 14 delivers heat to substrate 12 in a uniform manner, for example, by forming a plurality of heating zones which provides a concentrated heating profile with a greater amount of heat being applied to the outer perimeter of the substrate than the center of the substrate.
- Mahawili's non-contact emissivity measurement assembly 60 measures the emissivity and calculates the temperature of substrate 12 during fabrication processes. Specifically, a photon density sensor 70 measures the incident photon density from a light source 72 and measures the reflected photon density off the device side 12a of the substrate 12, and eventually the temperature of the substrate 12 is calculated. (Col. 8, line 44 – col. 9, line 60). Temperature readings taken by the emissivity measurement assembly 60 may be used to *deliver proportional power to each of the lamp zones within heater assembly 14* and, more generally, to monitor and control the output of heater assembly 14 or to adjust the profile of the applied heat. (Col. 9, lines 26-55; col. 10, lines 28-34).

Neither heater assembly 14 nor emissivity measurement assembly 60 ***provides a gas*** *to selectively control the temperature* of at least one localized region of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. Rather, any temperature control occurring in Mahawili relies on increasing or decreasing the output of the heater assembly, i.e., by increasing or decreasing the output of the heating elements such as the linear tungsten-halogen lamps.

The Office Action continuously refers to aspects of the gas injection assembly 34 in the reactor of Mahawili, which directs one or more reactant gases to the substrate during processing in a uniform and controlled manner (i.e., to discrete regions of the substrate). (Col. 4, lines 13-16 and 60-65). But Applicants respectfully point out that at no time does Mahawili ever state or suggest that gas flow through the gas injection assembly 34 is controlled in any way that would ***selectively control the temperature*** of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature.

As explained in Applicants' previous Response, the gas injection assembly 34 of Mahawili is adapted to produce "uniform deposition on the substrate." (Col. 3, lines 53-58). For example, in some embodiments of Mahawili, the gas injection system is broken up into gas injection segments 36, 38, and 40, which introduce one or more gases to a discrete area of substrate 12 through channels (i.e., 36a-d), each of which includes orifices 42. These orifices 42 may be arranged to provide the same flow rate of gas across the width of substrate 12 or may be arranged in a non-uniform pattern to vary the profile of the gas flow across the substrate. Also, the number of orifices 42 and the spacing between those orifices may be adjusted to provide "a more uniform flow or to direct more gas to one area of the substrate than another." (Col. 6, line 13 – col. 7, line 4).

Again, however, not a single portion of Mahawili's gas injection assembly 34 provides a gas ***to selectively control the temperature*** of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature.

The Figures of Mahawili even highlight the differences between Applicants' claimed methods and Mahawili's disclosure. Specifically, heater assembly 14, shown in Figures 2, 3, and 6, is located towards the bottom of reactor 10 and does not contain any sort of mechanism for "providing a gas." As best seen in Figure 2, heater assembly 14 is enclosed in a heater housing 16 and merely includes an array of heating elements such as linear tungsten-halogen lamps (not shown). Additionally, gas injection

assembly 34, shown in Figures 1 and 3-6, is located towards the top of reactor 10 and does not contain any sort of mechanism for "selectively controlling the temperature" of any portion of the substrate. As best seen in Figure 5, pieces of the gas injection assembly 34 (like orifices 42) can be manipulated physically to vary the gas *flow*, but with no indication that any part of gas injection assembly 34 can somehow selectively control the *temperature* of one or more localized regions of a substrate or wafer.

Applicants respectfully submit, then, that independent claims 1, 48, and 50 are not anticipated by Mahawili at least for the reason that Mahawili does not disclose or in any way suggest the step of providing of a gas to selectively control the temperature of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature.

Additionally, in the Office Action, claims 4, 6-7, 42, 46-47, 49, 52, 54-55, and 61—which include independent claims 46 and 49—were rejected under 35 U.S.C. § 103(a) as being unpatentable over Mahawili in view of U.S. Patent No. 5,874,711 to Champetier, et al. With regard to claims 46 and 49, the Office Action stated that Mahawili "substantially teach[es] the claimed method, as stated above," but does not "teach that the gas is supplied by a reflective device located below the semiconductor wafer." (Office Action at 5).

First of all, as set forth in detail above, Applicants have respectfully shown that Mahawili does not teach or in any way suggest the step in independent claims 46 and 49 that requires the providing of a gas to selectively control the temperature of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. And Champetier, et al. does not remedy this deficiency in the disclosure of Mahawili. Champetier, et al. is generally directed to a system and process for accurately determining the temperature of an object, such as a semiconductor wafer, by sampling from the object radiation being emitted at a particular wavelength.

While Champetier, et al. describes a reflective device (see, e.g., columns 7-8 and Figures 2-3), Champetier, et al. does not disclose or suggest the step (missing from Mahawili) of providing a gas to selectively control the temperature of at least one of a

plurality of localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. As shown in Fig. 1 of Champetier, et al., for instance, a processing chamber 12 is provided that includes a gas inlet 18 and a gas outlet 20 for introducing a gas into the chamber and/or for maintaining the chamber within a preset pressure range. (Col 6, lines 45-51). Yet, Applicants note that gas inlet 18 and gas outlet 20 do not provide selective control over the temperature of a *localized* region of wafer 14. Instead, gas inlet 18 and gas outlet 20 provide a gas to the entire chamber 12, and not selectively to any particular region of the semiconductor wafer. In short, Applicants respectfully submit that independent claims 46 and 49 patentably define over Mahawili and Champetier, et al., alone or in any proper combination.

The dependent claims were also rejected as being unpatentable over the references discussed in detail above. Applicants respectfully submit, however, that at least for the reasons indicated above relating to corresponding independent claims 1, 46, and 48-50, the dependent claims patentably define over the cited references. However, Applicants also note that the patentability of the dependent claims does not necessarily hinge on the patentability of independent claims 1, 46, and 48-50. In particular, it is believed that some or all of the dependent claims may possess features that are independently patentable, regardless of the patentability of claims 1, 46, and 48-50.

In summary, it is respectfully submitted that the claims are patentably distinct over the prior art of record and that the present application is in complete condition for allowance. Favorable action, therefore, is respectfully requested. Examiner Lee is invited and encouraged to telephone the undersigned at her convenience should any issues remain after consideration of the present Response.

Please charge any additional fees required by this Response to Deposit Account No. 04-1403.

Respectfully submitted,

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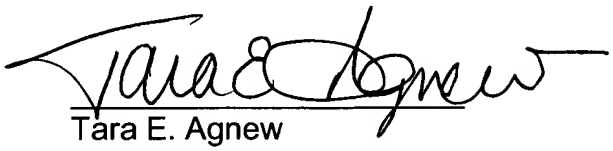

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